On-demand Bound Computation for Finding Leading Solutions to Soft Constraints

Martin Sachenbacher and Brian C. Williams MIT Computer Science and AI Laboratory

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Finding Leading Solutions

- Many AI problems = Constraint optimization problems
 Diagnosis (state estimation)
 - Planning
 - ...
- Practical AI requirement: Robustness ⇒ Generate solutions in best-first order, until halted
 Most likely diagnoses, until failure is found
 - Least cost plans, until actions are executable
- Problem: Not known in advance when halted ⇒ Must generate *each* solution as quickly as possible

Example: Full Adder Diagnosis

- Variables {u, v, w, y, a1, a2, e1, e2, o1}
- {a1, a2, e1, e2, o1} describe modes of gates
- Gates are either in good ("G") or broken ("B") mode



Example: Full Adder Diagnosis

- And-gates broken with 1% probability
- Or-, Xor-gates broken with 5% probability
- Probabilistic valuation structure ([0,1], ≤, *, 1, 0)



Modelin	ng ti	he Examj	ole a	is Soft CS	SP_
$f_{a1}:a1$ w y		f_{a2} : a2 u v		f_{e1} : e1 u y	
G 0 0	.99	G 0 0	.99	G 1 0	.95
G 1 1	.99	G 1 1	.99	G 0 1	.95
B 0 0	.01	B 0 0	.01	B 0 0	.05
B 0 1	.01	B 0 1	.01	B 0 1	.05
B 1 0	.01	B 1 0	.01	B 1 0	.05
B 1 1	.01	B 1 1	.01	B 1 1	.05
<i>f</i> ₀1 : <u>o1 v w</u>		f_{e2} : e2 u \mid			
G 0 0	.95	G 0	.95		
B 0 0	.05	B 0	.05		
B 0 1	.05	B 1	.05		
B 1 0	.05				
B 1 1	.05				



































































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Т	C	N	K	BFTC (% time)	BFOB (% time)
4	20	15	4	100%	1.4%
8	20	15	4	100%	3.2%
T	a	M	V	DET(1/(2/(1-1)))	
1	C	IV	n	BFIC (% time)	BFOB (% time)
4	15	10	4	100%	4.5%
8	15	10	4	100%	14.3%
-	~				
T_{-}	C	N	K	BFTC (% time)	BFOB (% time)
4	20	10	4	100%	9.7%
0	20	10	4	100%	38.8%











